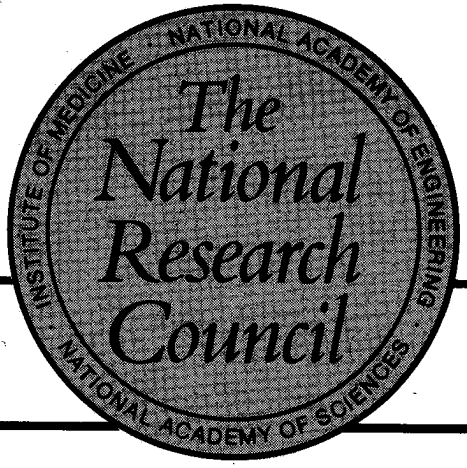
The Effects of Whole-Body Vibration on Health



Committee on Hearing, Bioacoustics and Biomechanics

Assembly of Behavioral and Social Sciences

THE EFFECTS OF WHOLE-BODY VIBRATION ON HEALTH

Report of Working Group 79

Committee on Hearing, Bioacoustics, and Biomechanics
Assembly of Behavioral and Social Sciences
National Research Council

National Academy of Sciences
Washington, D. C.
1979

NOTICE

The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the Council of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the Committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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Committee on Hearing, Bioacoustics, and Biomechanics (CHABA)

Working Group 79 - The Effects of Whole-Body Vibration on Health

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At the request of the National Institute for Occupational Safety and Health (NIOSH), CHABA Working Group 79 on the effects of whole-body vibration on health was convened to consider whether or not there is a medical problem resulting from chronic occupational exposure to vibration.

The Working Group concludes that clinical health effects from prolonged occupational exposures to whole-body vibration have not yet been clearly established. This appears to indicate that for most common exposures there is little or no direct risk to health. On the other hand, because it is possible for such vibration to be of a magnitude or quality that can produce annoyance and pain and that can lead to functional alterations such as muscular weakness, high blood pressure, fatigue, and decreased nerve conduction velocity, sober consideration must be given to the possiblities for such clinical health effects and to safe limits for exposures. Even though all presently known effects are assumed to be reversible, they nontheless may have an effect on the productivity and efficiency of the factory worker and perhaps on his well-being. Chronic effects on the musculo-skeletal system and the urinary tract have been suspected to be produced by some more severe exposures. A balanced research program on the effects on human health of chronic exposure to whole-body vibration needs to be developed in order to permit the setting of standards for vibration.

1. Field studies should be continued for high-dose populations such as truck drivers, bus drivers, heavy equipment operators, foundry workers, farm tractor drivers and commercial helicopter pilots. These

studies must include environmental exposure data as well as epidemiological evidence of increases in morbidity. A description of the vibration environment which is as complete as possible is essential to the establishment of a meaningful vibration standard through the establishment of correlations of various exposure parameters with specific detrimental conditions. In this regard, one must be sure that workers in their off-duty time are not getting additional dosages of vibration. Epidemiological data should include absenteeism and job turnover rates as well as failure of physiological systems such as the skeletal, cardiovascular, or gastrointestinal systems.

2. Simultaneously, clinical studies should be conducted toward identifying any effects in the musculoskeletal system (i.e. insidious arthritis, lumbo-sacral strains, sciatica, lumbar disc syndrome, and facet syndrome), cardiovascular system (hypertension, coronary artery disease, obstructive syndromes, and vasospastic syndromes), gastrointestinal system and genitourinary system. Other disease conditions that may be aggravated would be spinal compression fractures, Schmorl's nodes, ankylosing spondylitis, spondylolisthesis, spondylosis, Scheurman's disease, supply spondylosis, detached retina, prostatitis, and ulcers of the stomach and small intestines.

3. Laboratory studies to parallel and explain findings under 1 and 2 should be oriented toward investigation of the physiological responses. Work should concentrate on the abdominal organs and their response to whole-body vibration. In order of importance these organs would be the gastrointestinal tract, endocrines (especially with respect to the pregnant subject), kidney, and liver. Other parts of the

body are felt to be adequately covered by current laboratory research programs. The purpose of the laboratory analysis should be to (a) attempt to define damage mechanisms for those pathological conditions identified as vibration-related by the field and clinical studies. b) study vibration effects in isolation from other environmental stressors, and (c) study the interrelationship between vibration effects and the effects of other environmental stressors. Other environmental stressors should include realistic stimuli such as heat, noise, and noxious fumes.

The whole spectrum from low- to high-frequency vibration needs to be considered. Repetitive impacts of various pulse shapes must be studied as part of the vibration continuum. Exposure time must be another experimental parameter. The adequacy of various environmental descriptors such as long-time averages, weighted rms-values, crest factors and the effects of individual peak exposures must be investigated.

The preponderance of whole-body vibration exposure is in the vertical direction with the subject either seated or standing. Other axes of vibration appear of minor importance for workers in industry.

Until more definitive knowledge is obtained, very strong consideration should be given to permitting women who are pregnant and exposed to vibration exceeding "normal" magnitudes (see ISO standard 2631 - 1974 "Guide for the Evaluation of Human Exposure to Vibration") to obtain leave from their jobs while they are pregnant.

Although the identification of an entity which might be called vibration disease may be difficult, a decrease in the efficiency,

production, and well-being of workers alone would justify research leading to vibration standards. It may be that there is no vibration disease as such from whole-body vibration comparable to the well established vibration disease from hand-transmitted vibration, but that vibration simply acts to exacerbate existing disease states in individuals. Clarification of this point appears highly desirable.

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For most common prolonged occupational exposures to whole-body vibration there appears to be little or no direct risk to health. However, it is possible that exposure could be annoying or painful and this could lead to functional alterations such as muscular weakness, high blood pressure, fatigue, or decreased nerve condition velocity. Exposure may also act to exacerbate existing disease states. Specific research guidelines are offered.

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